Dental avulsion: therapeutic protocols and oral health-related quality of life

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*Abstract. **Aim** Aim of this study is to describe OHRQoL (oral health-related quality of life) among patients who have had a complete dislocation of the tooth out of its socket (Tooth Avulsion). The study also sought to identify clinical evidence, associated with OHRQoL, of the ideal therapeutic choice after tooth avulsion among these patients under 18 years old.. **Study design.** 73 patients under 18 year old were selected between 101 studied:, they received different therapeutic treatments, after one year adverse impacts on OHRQoL were measured using the 14-item OHIP. **Results** Our findings show that if patients got into tooth avulsion their quality of life is adversely affected. In this study, 21.2 % of subjects reported 1 or more of the 14 OHIP items during the preceding 12 months, which is significantly high. In group A just 4 % of subjects reported 1 or more of the 14 OHIP items, while in the other groups the percentage rise, reaching 50% in group F. Group C D G reported a value of 20%, while in group E this value is 12%. **Conclusion** This study shows how different treatment options have different effects on quality of life; the ideal one is the immediate replantation, when this is not possible RPD or functional appliance seem to be the best choice.*

Keywords: Tooth avulsion, Therapy, OHRQoL

Introduction

The incidence of dental trauma as a result of falls, bicycle accidents, skateboards and other sports activities is higher in children and adolescents and maxillary incisors are the teeth most commonly affected. The anterior maxilla is the most traumatized region of the mouth during childhood. The peak age for these injuries is 9 to 10 years.

Avulsed teeth represent about 16% of dental injuries [Andreasen JO, et al, 2000].

The therapy aims to avoid or minimize the inflammatory reactions occurring as direct consequence of the avulsion.

The single factor playing a fundamental role in dental replantation's success is the speed of replantation.

The critical value between success and failure is 15-20 minutes from the traumatic event hence a proper and immediate reaction becomes a key variable.

The management of dental avulsion is a disputed matter [Kenny DJ et al, 2003].

As for every trauma the therapeutic intervention has to be determined by the application of the best scientific evidences and considering the clinician's experience and patient's expectations.

Numerous guidelines have been published about the replantation of avulsed elements by organizations such as the American Association of Endodontics[AAE, 1995], the Royal College of Surgeons of England[RCSE, 1997]. and the International Association of Dental Traumatology[Flores MT et al, 2001].

Replantation-associated root resorption can often result in complications such as infra-occlusion leading to poor aesthetics, tilting of adjacent teeth, loss of function and eventually loss of the affected teeth. The benefit of tooth replantation in such cases is mainly the time gained to establish an optimal permanent treatment plan and preservation of the width of the alveolar bone.

Following completion of jaw growth, an ankylosed tooth can be readily replaced with a fixed restoration or with an implant. The potential use of dental implants in childhood should be considered.

However while there is no evidence for a lower age limit for the process of osseous integration to be

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successful, osseointegrated implants act similarly to ankylosed teeth and, therefore, lack the ability of natural teeth to compensate for skeletal bone changes in growth [L.J. Oesterle et al, 1993]. While this may be acceptable in adult patients, it is a significant factor to consider in adolescent or younger patients who are still growing [S.R. Bryant et al, 1998]. Possible complications of the placement of implants too early in life include the submerging of an implant into the jaw, loss of support for the implant, relocation of the implant, and potential for interference with normal growth of the jaws.

While the maxilla is developing in a downward and forward direction, the ankylotic tooth remains more or less in infraocclusion depending on the age at the time of injury and the individual growth pattern. This leads to poor aesthetics and functional loss. After loss of a traumatized anterior permanent maxillary incisor in young adults, there are few treatment options: orthodontic closure of the gap or maintaining the gap with a temporary restoration for future bone augmentation and implant placement.

It becomes very interesting to evaluate the influence of different therapeutic protocols on quality of life.

Oral health related quality of life measures have been developed because objective clinical measures of disease provided little insight into the impact of oral disorders on daily living and quality of life [Allen PF, 2003]. The value of oral health related quality of life measures in the description of the experience of disease and treatment could be enhanced further through the development of a summary utility

index that could measure health state values on a scale from zero to one where zero represents worst health and one best health [Brazier JE et al,2004].

The aim of this study was to describe OHRQoL among patients who have had a complete dislocation of the tooth out of its socket (Tooth Avulsion).

The study also sought to identify clinical evidence, associated with OHRQoL, of the ideal therapeutic choice after tooth avulsion among these patients under 18 years old.

Oral health related quality of life

Materials and Methods

The data for these analyses were obtained from a larger study designed to examine the management of tooth avulsion. The larger study was a prospective multicentric clinical trial that was conducted at the Dental-Traumatology Department of the University of Modena and Reggio Emilia and at the Dental-Traumatology Department of the University of L'Aquila, over a 3-year time period, still in action, when 101 subjects had been recruited.

After consenting to participate in the study, and after an adequate rehabilitation, patients were interviewed and completed questionnaires that asked about demographics, about the ethiopatogenesis, and OHRQoL. Adverse impacts on OHRQoL were measured using the 14-item OHIP.[G.D. Slade,1997]

In dentistry, one of the more widely used measures of oral health-related quality of life (OHRQoL) is the Oral Health Impact Profile (OHIP).[G.D.Slade, 1994] The OHIP questionnaire asks about the adverse impacts of oral conditions on aspects of well-being including pain, psychosocial states, social interaction, and daily activities. The OHIP questionnaire has also been used in population studies in the United States, Canada and Australia.

The Oral Health Impact Profile (OHIP) is a disease-specific measure of people's perceptions of the social impact of oral disorders on their well-being [Slade GD et al 1994]. OHIP contains 49 questions that capture seven conceptually formulated dimensions based on Locker's theoretical model of oral health [Locker D., 1988], and the OHIP-14 was developed as a shorter version of the OHIP for settings where the full battery is inappropriate [Slade GD, 1997].

Patients were also asked to rate their experience of dental problems in the last year using the OHIP-14 [Slade GD, 1997], which uses 14 items to capture measures of the seven dimensions of functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. For each of the 14 OHIP questions subjects were asked how frequently they had experienced impact in the preceding 12 months.

Responses were recorded on a 5-point scale: "Never" (code 0), "Hardly Ever" (code 1), "Occasionally" (code 2), "Fairly often" (code 3), or "Very Often" (code 4). The main dependent variable for this analysis was the number of items reported "Fairly often" or "Very often." When computing the summed OHIP score, we excluded subjects who had missing or "don't know" responses to more than 2 OHIP items [Slade GD et al, 2004].

No statistic evaluation was done because various numeric concistency of different groups

Results

Of 101 patients with tooth avulsion 73 were younger than 18 years (Table 1); the mean age of the enrolled patients was 13.5 years. 63.4% were female and 36.6% were male.

	101 patients
Age	
% under 18 years old	72.27 (73)
Sex	
% Male	63.4 (64)
% Female	36.6 (37)
Tooth Avulsed	
% central incisors	49.5 (50)
% lateral incisors	13.8 (14)
% more than one element	36.7 (37)
Time since last dental visit	
% visited in last month	39.6 (40)

TABLE 1 - *Characteristics of patients.*

It was a single tooth avulsed in 63.3 % of the population, 49.5%was central incisor.

21.2% of subjects reported experiencing 1 or more of the 14 selected oral health impacts "fairly often" or "very often" in the 12 months before enrollment in the study (Table 2).

In group A just 4 % of subjects reported 1 or more of the 14 OHIP items, while in the other groups the percentage rise till 50% in group F.

Group C D G reported a value of 20%, while in group E this value is 12%.

Discussion

Orthodontic space closure. Orthodontic space closure is one of the treatment alternatives when a maxillary incisor is missing: selecting the appropriate treatment option depends on the malocclusion, the anterior relationship, specific space requirements, and the condition of the adjacent teeth. The ideal treatment is the most conservative alternative that satisfies individual aesthetic and functional requirements. Closing spaces and replacing missing maxillary lateral incisors by using the canines is indicated in full-lip profiles when anterior teeth are severely protruded, or tipped labially [Roy Sabri , 1999]. In such cases, opening spaces for the missing lateral incisors will make anterior teeth protrude even more, thus worsening the patient's profile and compromising the long-term stability of the end result. If the patient has a balanced profile with normally inclined anterior teeth and minimal or no space available in the maxillary arch, orthodontic space closure is indicated. Whenever teeth in the mandibular arch need to be extracted for orthodontic reasons— such as severe crowding or protrusion—orthodontic space closure by using canines to replace missing lateral incisors is indicated in the maxillary arch. The major advantage of orthodontic space closure is the permanence of the finished result. At the end of orthodontic treatment, the overall treatment is completed and the result is permanent. The tendency of the space between the anterior teeth to reopen is the major disadvantage of space closure [Faure J et al, 1994].

Moreover the importance of a canine protected occlusion on lateral movements has to be considered: when canines have been advanced to replace laterals and close space, there is no opportunity for canine rise during lateral mandibular movements [Robertsson S et al, 2000]. Orthodontic space closure has very clear orthognatodontic indications, this is in fact a therapeutic choice that has to be realized respecting the gnathological hexagon; even if the number of patient undergoing this kind of rehabilitation is very low, this is the group with the higher value of OHIP and discomfort.

Fixed denture (conventional bridges). A comprehensive study of existing conditions through clinical evaluation, radiographic evaluation and the use of diagnostic casts is essential in determining the appropriate treatment plan.

One must evaluate the abutment teeth and their supporting structure to determine if they can sustain the load which they will be subjected to. The crown to root ratio and periodontal health must be assessed. The retentive qualities of the proposed retainer must be determined as well as their aesthetic qualities.

An important aspect which cannot be overlooked is the maxillo-mandibular relationship and the load that will be applied on the bridge.

Ante's law should always be considered when deciding on the number of abutment teeth required.

The fulcrum line which passes through the abutment teeth and the lever arm which is created by the pontic must be assessed.

Generally the point of greatest leverage on the bridge must be supported by an abutment or the areas of retention must be extended in each direction away from the spaces far enough to counteract the lever arm and establish counterbalancing retention [DykemaRW, 1962].

The youth of the patient has to be considered, the opportunity to leave the maxillary cuspids as unrestored teeth which are in function against the mandibular cuspids, and the possibilities to avoid splinting of adjacent teeth thus allowing the patient to maintain better oral hygiene [Silness J et al, 1974].

Maryland bridge. The use of a resin-bonded fixed

Variable	Group A	Group B	Group C	Group D	Group E	Group F	Group G
Trouble pronouncing words							
Never	40	4	0	3	5	1	3
Hardly ever	2	0	2	1	2	1	2
Occas., F/Often, V/Often	1	2	1	1	1	0	1
Sense of taste worsened							
Never	39	3	3	2	6	2	5
Hardly ever	2	2	0	2	2	0	1
Occas., F/Often, V/Often	2	1	0	1	0	0	0
Painful aching in mouth							
Never	41	5	0	1	7	2	5
Hardly ever	2	1	2	2	1	0	1
Occas., F/Often, V/Often	0	0	1	2	0	0	0
Uncomfortable eating							
Never	33	3	0	3	6	1	6
Hardly ever	8	1	3	1	1	1	0
Occas., F/Often, V/Often	2	2	0	1	1	0	0
Felt self-conscious							
Never	37	4	3	4	5	2	5
Hardly ever	5	0	0	1	1	0	1
Occas., F/Often, V/Often	1	2	0	0	2	0	0
Felt tense							
Never	38	2	2	3	6	1	4
Hardly ever	2	3	1	2	3	0	2
Occas., F/Often, V/Often	3	1	0	0	0	1	0
Diet unsatisfactory							
Never	40	4	0	5	4	2	5
Hardly ever	3	2	2	0	3	0	0
Occas., F/Often, V/Often	0	0	1	0	1	0	1
Interrupt meals							
Never	39	3	3	2	5	1	4
Hardly ever	2	2	0	2	3	1	2
Occas., F/Often, V/Often	2	1	0	1	0	0	0
Difficulty relaxing							
Never	42	5	1	3	6	1	4
Hardly ever	1	1	1	2	1	1	1
Occas., F/Often, V/Often	0	0	1	0	1	0	1
Been embarrassed							
Never	43	5	1	2	5	2	3
Hardly ever	0	1	2	3	2	0	3
Occas., F/Often, V/Often	0	0	0	0	1	0	0
Irritable with other people							
Never	43	4	2	1	7	1	5
Hardly ever	0	0	1	4	1	1	1
Occas., F/Often, V/Often	0	2	0	0	0	0	0
Difficulty doing usual jobs							
Never	41	5	1	4	6	2	4
Hardly ever	0	0	1	1	2	0	2
Occas., F/Often, V/Often	2	1	1	0	0	0	0
Life less satisfying							
Never	43	6	2	4	6	1	5
Hardly ever	0	0	1	1	1	1	1
Occas., F/Often, V/Often	0	0	0	0	1	0	0
Unable to function							
Never	35	5	0	3	6	2	4
Hardly ever	6	1	2	2	1	0	2
Occas., F/Often, V/Often	2	0	1	0	1	0	0

Legend: Group A: replantation; Group B: Maryland bridge; Group C: Autotransplantation; Group D: composite reinforcement fiber; Group E: Removable partial prosthodontics; Group F: Orthodontic space closure; Group G: functional appliance.

TABLE 2 - *OHIP-14.*

partial denture (RBFPD) is the preferred option of treatment when the abutments are relatively intact [Botelho MG, 2003]. RBFPD applications are used following orthodontic treatment to reestablish normal spacing in the anterior segment. Assessment of function and patient satisfaction with their restorations revealed 88% rated the appearance as good, while 94.9% regarded the function as good. Usually applied to the space between the canines in the mandible, such appliances can also be extended to the mandibular first or second premolars [Kahl-Nieke B, 1996].

Selection of a RBFPD instead of an FPD was done to adhere to the principle of using a minimally invasive approach to conserve tooth structure and to take advantage of adhesive dentistry. The survival rates of RBFPDs reported in literature vary widely, and the conclusions are sometimes conflicting. Reported RBFPD survival rates range from 74 to 95%. In their study Zalkind et al. reported that the amount of debonding was high in the RBFPDs made after orthodontic treatment; at the end of the follow-up period survival level of the study population was 85 months ± 13%. They also reported rebonding the RBFPDs once increased the overall functional survival rate to 112 months ± 10% and multiple rebonding led to a further increase to 131 months ± 8%. Ketabi et al. reported a mean survival rate greater than 69% after a 13-year observation period was calculated. A mean functional survival rate of 83% was estimated with rebonded restorations. A total of 18 failures (24.3%) of all restorations were observed with the primary cause being loss of retention [Ketabi AR et al, 2004]. The rehabilitation with Maryland Bridge is a very good option, ideal for aesthetics and function, but it has very clear limits, like the age of the patient, the complete eruption of the abutment teeth, the occlusion typology and the compliance. For this reason the value obtained in this study is very high.

Composite reinforcement fibers. The development of fiber-reinforced composite (FRC) resins has provided a class of materials with significantly increased strength when compared to particulate composite resins alone [Freilich MA et al, 1998; Freilich MA et al, 2000]. This may be a significant factor in strengthening the critical connector area between the pontic and its attachment to the abutment teeth. The often-used alternative of attaching an artificial tooth adapted to fit the edentulous space has a number of problems that the FRC technique overcomes. The lack of chemical bond between the particulate composite resin and the acrylic resin of the artificial tooth, which can serve as a source of failure intraorally, is eliminated. The FRC provides increased strength in the critical connector area to decrease the potential for fracture. Also, most clinicians rely on 2 abutment teeth to retain an artificial tooth pontic, whereas a cantilever approach can be used with the FRC provisional prosthesis because of its strength characteristics. The use of resin-preimpregnated FRCs for various designs of direct chairside FPDs in situations not associated with integrating implants has been reported.[Meiers JC et al,2001; Freilich MA et al,2004] The rehabilitation with composite fibers is similar to the Maryland Bridge, it has the same indications and contraindications , but the high value of debonding makes this a short period rehabilitation.

Autogenous Tooth Transplantation. Auto-transplantation of the first mandibular premolar to the anterior region immediately after tooth extraction poses another good treatment option even as a temporary solution until growth and development are completed. The method for autotransplantation of immature premolars was developed at the University of Oslo, Norway, by Drs Slagsvold and Bjercke, and first described in publications [Slagsvold O. et al, 1967] in the late 1960s and early 1970s. This means that several patients in Norway now have follow-up periods of 30 years or more after having had premolars transplanted from one region to another. The most successful procedure involves transplanting premolars before the root is fully formed. This way, pulp revascularization and vitality can be preserved, and the tooth retains the potential to erupt and induce alveolar bone growth. The loss of alveolar bone associated with traumatic injuries to the teeth and surrounding tissues can generally be reversed. Andreasen et al. [Andreasen JO et al, 1990] reported survival rates of more than 90% in a comprehensive study, but only a few of the transplants were observed more than 10 years. Schwartz et al. presented a mean observation time of 10 years (range, 1–25 years) (one tooth) for transplanted teeth. Czochrowska et al. [Czochrowska EM. Et al, 2002] reported a 79% to 90% success rate in 30 transplanted teeth 17 to 41 years post-treatment. This option is suitable for selected patients when a first mandibular pre-molar can be spared. Autogenous tooth transplantation requires orthodontic cooperation to close the gap after the first mandibular premolar extraction. The transplant can replace a missing tooth to preserve bone until completion of growth. Then, if necessary, the patient can become a candidate for dental implants. The autotransplantation is an optimal option for aesthetics and function but it has a repercussion on the quality of life because of the first

period, in which there is a discomfort for the patient.

Removable partial prosthodontics. Removable partial prosthodontics is a versatile, cost effective, and reversible treatment method for partially edentulous patients at any age. [Sadig WM et al, 2002]. With the changing trends in dental treatment that favour retention of natural teeth, a decline in the number of complete dentures with an increase in the number of removable partial dentures (RPDs) is anticipated [Harvey WL et al, 1989].

The objectives of RPD design have been well established. They include the restoration of function, enhancement of aesthetic and, most importantly, the preservation of the remaining teeth and periodontal structures [Krol AJ et al , 1990]. The primary purpose for the Kennedy's classification of partially edentulous arches is to identify potential combinations of teeth to edentulous ridges in order to facilitate communications among dental colleagues, students, and technicians. Edward Kennedy's book Partial Denture Construction was published in 1928. A number of the principles that he advocated are still taught, albeit in a modified manner, although the background reasoning supporting those principles has changed somewhat [Basker RM, 2002]. Evidence for indications and contraindications for the prescription of removable partial dentures is not clearly stated in the literature; however, some basic principles are defined. There appears to be a trend in favour of the use of the shortened dental arch concept or implant-supported restorations instead of conventional removable partial dentures, given the evidence that the long-term use of removable dentures is associated with increased risks of caries and periodontitis and low patient acceptance. The presence of sound abutment teeth appears to encourage the use of removable partial dentures, as the fixed partial denture alternative requires sacrifice of healthy hard tissues. When economic factors influence the decision-making process, removable partial dentures are often chosen [Wostmann B et al, 2005].

RPD and Functional Appliances seem to be very good options able to rehabilitate aesthetics and function immediately even in non-complying patients.

RPD has the lowest value after replantation; in this study it has been decided to use titanium, because of its mechanical characteristics and weight.

Functional appliance. The history of the functional appliance can be traced back to 1879, when Norman Kingsley introduced the "bite-jumping" appliance. In the early 1900s, parallel development began in the United States and Europe in fixed and functional techniques, respectively, but the Atlantic Ocean was a geographic barrier that restricted the sharing of knowledge and experience in these philosophies. The only exception to this was the fixed functional appliance designed by Herbst [Proffit WR et al, 2000]. The monobloc, developed by Robin in 1902, is generally considered the forerunner of removable functional appliances, but the activator developed in Norway by Andresen in the 1920s was the first functional appliance to be widely accepted, becoming the basis of the "Norwegian system" of treatment. Both the appliance system and its theoretical underpinnings were improved and extended elsewhere in Europe, particularly by the German school led by Häupl, Bimler, and Balters. It would be after midcentury before functional appliances were reintroduced into American orthodontics. Functional appliances can be fixed (eg, Herbst, Jasper Jumper) or removable (most). Proffit and Fields suggested a further classification, based on the appliance's platform. [Wahl, 2006] Functional appliances are low cost, easy to use and to manage and represent a valid treatment option for restoring aesthetics and function, improving facial growth. Functional Appliance presents the same characteristics of RPD, but it has different indications; in fact it's been used in case of malocclusion, so it is not a rehabilitation of the detail, but of the entire stomatognatic system.

Conclusion

The principal finding from this study was that adverse impacts on OHRQoL were reported much more frequently among patients who got into failure of replantation compared with patients who got into successful replantation. This main result is not surprising, because tooth replantation, when successful is the ideal treatment option for aesthetics, function and psychological impact.

As thinking about health has matured, OHRQoL, which involves eating and social interaction, is now accepted as an integral part of overall health. This is a very different view than that prevailing only a few decades earlier when oral health was assumed to be unrelated to general health and well-being except in special circumstances. Accompanying this change in perspective is the obvious need to measure clinical conditions that influence OHRQoL.

Our findings show that if patients got into tooth avulsion their quality of life is adversely affected.

The results show how the Gold Standard is the

immediate replantation, while the other therapy options seem to have similar repercussion on OHRQoL.

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